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Economic decision-making in free-to-play games: A laboratory experiment to study the effects of currency conversion

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Abstract: We present initial results from a controlled laboratory experiment where the economic decision-making typical in free-to-play games was studied. The participants were presented with a series of scenarios, where they rated how much they were willing to pay (in euros, in hard currency, or in soft currency) for common in-app virtual goods (booster, unlock, timer). The goal of the study was to examine how the multiple currency conversions and the amount of resources affect the perceived value of the virtual goods and the willingness to pay for them. The results don't support the notion that the currency conversions would lead to increased spending. When comparing the willingness to pay in different currencies by first converting them to a unitary currency, the participants were willing to use highest amount of resources when considering purchases in euros and least when considering purchases in soft currency. However, when considering purchases with euros, the participants were willing to pay most when they had moderate amount of virtual currency. But with gold the willingness to pay was highest when the amount of resources was the highest. This finding highlights the differences in how the players may process real money and in-game currencies. In addition, the results imply that regardless of the currency type, the participants were willing to pay most for unlocking of new game content. It is suggested that the economic decision making in free-to-play games could be studied also with abstract and simplified laboratory experiments.

1. Introduction

In online game market there are two dominant business models: subscription-based model where the player must pay a monthly fee to access games, and free-to-play model (Park & Lee, 2011). Free-to-play games can be obtained free of charge, however, the games are designed such that to proceed in the game one must buy different types of virtual goods, such as boosters that enhance the performance, or openings for time locks that hinder the progress in the game (e.g., Hamari, Hanner, & Koivisto, 2017). Thus, the core service or product is free, and the actual revenue is collected by in-game purchases and premium services (Hamari, Hanner, & Koivisto, 2017; Kumar,

2014; Liu, Au, & Choi, 2014). The free-to-play revenue model has been used in games on various platforms: computers, gaming consoles, and especially in mobile games.

Altit (2013) divides the free-to-play games into two categories based on their monetization mechanisms. First category is the "Free to download but not necessarily free to play" games, which, at least in principle, can be played for free, but proceeding in the game without making any purchases is made difficult; for example, Pokémon GO and Trials Frontier utilize this mechanism. The other category is "Pay or wait" games, where the player has an option to unlock time locks to speed up gameplay by making in-game purchases, although, technically it is possible to play the game without investing any real money, by waiting the time lock to unlock. This mechanism is utilized in some of the highly popular free-to-play games, such as Candy Crush Saga and Clash of Clans. It must be noted, however, that a single game may utilize both these mechanisms, and thus, a strict categorization by a one monetization mechanism may not be informative. There have also been attempts to taxonomize the in-game purchasable virtual goods. Luton (2013), for example, has divided the possible virtual items that could be purchased in games to four different classes: 1) Downloadable content, like new levels and characters; 2) Convenience, something that would have been laborious to achieve by playing; 3) Competitive advantage, typically against the game or other players; and 4) Customization, for example personalizing items for the character.

Usually number of currency conversions are needed before the virtual goods can be obtained in a free-to-play game (e.g. Alha et al., 2014). A widely used mechanism is to have the player first purchase hard currency (e.g. diamonds in Clash of Clans game) with the real money (e.g., euros). The soft currency (e.g. coins in Clash of Clans) can be purchased with the hard currency; and finally, the virtual item in the game can be purchased with the soft currency. In some games the soft currency can be obtained also by playing the game, but the hard currency can only be obtained with the real money, and there may be exclusive virtual goods that can be obtained only with the hard currency. On the other hand, in some games in addition to purchasing with real money, also the hard currency can be obtained by playing, but only to certain amount. Typically, the hard currency is sold in bundles, for example ten diamonds could be $1.99, and one hundred diamonds could be $18.99 (Hanner & Zarnekow, 2015).

The "double currency model" used in free-to-play games effectively obfuscates the amount of real money being spent when buying the virtual goods. This could lead to spending more money in the game than the player originally intended. Another reason for utilizing these conversions is to keep the gameplay smooth and not interfere it with real world elements, such as real money. This suggestion was supported in a study by Lin and Sun (2011), who reported that players viewed buying items with virtual money as gaming behaviour and buying items with real money as shopping behavior (which could interfere with the enjoyment of the game).

Previous studies have shown that people resort to various strategies, some of them which are not optimal, when mentally converting between different real currencies (Lemaire & Lecacheur, 2001; Lemaire, 2007). The use of non-optimal strategies in currency conversion may be due to innate tendency to save cognitive resources and avert actual calculations between the currencies. As suggested by the theory of cognitive myopia, one may focus during decision making only on information that is immediately related to the decision, for example to the shown price of a virtual good in an in-game currency without conducting the cognitively laborious conversion to real money (Huang & Lin, 2017; Hsee et al., 2003). When the exchange rate between the real and the virtual currency is not shown to the player, they may perceive the price of a virtual item higher, since the players resort to the most salient price information and the virtual item's price in the

virtual currency is higher in numerosity (Huang & Lin, 2017; Bagchi & Davis, 2016). This effect of considering a product to be more expensive if the price is in a currency of higher numerosity is also referred as face value effect (Huang & Lin, 2017; Wertenbroch, Soman, & Chattopadhyay, 2007). In the context of free-to-play games the real currency would be of lowest numerosity, hard currency second highest, and soft currency of highest numerosity. On the other hand, the high numerosity of the virtual currency may lead the player to distance it from the rea currency and to consider it as "play money", and thus spend it more carelessly.

2. Current study

Economical decision making has been studied extensively, also in the context of purchasing virtual goods (e.g. Guo & Barnes, 2012). However, free-to-play games have certain defining characteristics that may affect the decisions to buy the in-game content. Often the free-to-play games can be played without making any purchases. However, to proceed in the game multiple purchases (each of them often of small value) are needed. Thus, the motivational factors affecting each of these small purchases are different from, for example, purchasing more traditionally a whole game at once, before even playing it. Specifically, the double currency model of the free-to-play games (see, Chapter 1) is suggested to affect the perception of the value of the virtual currency. This may affect the processes of economic decision making. Existing studies on in-game purchase of virtual goods have focused mainly on the player's motivations for obtaining the goods, or to related social factors (e.g., Huang & Lin, 2017; Wohn, 2014). The issues related to buying decisions in free-to-play games should be studied more thoroughly. After all, as high as 98% of players of a casual game have been reported to never spend their money on it (Campbell, 2014). In addition, monetary sacrifices have been reported to be the strongest factor in predicting the players to abandon a game (Wei et al., 2015).

In this study we focus to the effects of the in-game currency conversions to the willingness to pay for virtual in-game products. To the best of our knowledge, there is a lack of previous studies on this topic conducted with the current methodology.

As an exploratory research question we study how the currency conversion affects willingness to pay when considering to purchase virtual goods. Previous studies have shown that resource scarcity may lead to decreased spending, e.g. Carrol, Hall, & Zeldes, 1992). Thus, we also explore the effect of the amount of current resources in this decision-making process. Finally, since the in-game currencies may be bought with real money or they may be obtained by playing (see, Chapter 1), we also study exploratively the effects that how the resources have been obtained may have on the willingness to pay.

3. Methods

Given that economic decision-making in free-to-play games is a complex phenomenon to study, it is suggested that diverse methodology should be employed. We present as one possible approach to use controlled laboratory experiments where the participant is presented with simplified and abstract scenarios. Due to the laborious data collection, within-subject design is the most commonly used design type in psychophysiological decision-making experiments. Thus, we chose to use within-subjects design.

Altogether 21 participants completed the experiment. The participants had experience in playing free-to-play games. The participants responded in each of the independent 27 scenarios how much they would be willing to pay for the offered in-game purchase. The offered goods were a timer which would open a time-lock, a booster which would help in completing a level, and an unlock that would open new levels to play. A 3 x 3 x 3 setting was employed, consisting of the following manipulations: 1) the amount of resources the player has: scarce, moderate, or plenty; 2) the virtual good that is offered: timer, unlock, or booster; and 3) how the currency has been obtained (virtual currency earned by playing, virtual currency earned by buying with real currency, real money used).

At the beginning of the experiment the participants were described how they would have played their favorite free-to-play game and during the playing the game would present an offer to purchase an item. The participants were informed also about the relations between the different currencies. The euro (€) to diamonds (D) rates were: 2€ = 25D, 5€ = 55D, 12€ = 135D. The diamonds to gold (G) rates were set as: 4D = 65G, 15D = 250G, 50D = 830G. Thus, the rates represented linear relations between the currencies, but this was made difficult to notice for the participants by presenting amounts of currencies that could not be easily divided mentally. Two professional game developers were consulted to set the limits for different resource levels; in the conditions of scarce resources the participants were informed that they had 10/200D or 50/1000G, in the condition of moderate resources the amounts were 40/200D and 200/1000G, and in the conditions of plenty resources the amounts were 100/200D or 500/1000G.

The data were analyzed with SPSS by the linear mixed-models (LMM) procedure with restricted maximum likelihood estimation and an AR1 covariance structure for the residuals. Willingness to pay (in euro, diamonds, gold) was set as the dependent variable, and the Amount of resources, How the currency was obtained, and Product, were set as independent variables. Presentation order of the stimulus was set as the repeated variable and a model was specified where there were fixed effects for Amount of resources, How the currency was obtained, and Product.

4. Results

When examining the participant's overall willingness to pay over all products and resource conditions, it was observed that, not surprisingly, the willingness was highest for the most numerous currency, the Gold (Fig 1., left panel), then for the Diamonds ($p < .001$, for pairwise comparison). However, when converting the willingness to pay in Euro and the willingness to pay in Gold to Diamonds, it was observed that, after all, the participants were willing to use largest amount of resources when considering purchases in Euros, then Diamonds and least with Gold ($p < .001$, for pairwise comparison between Diamonds and Gold; Fig 1., right panel).

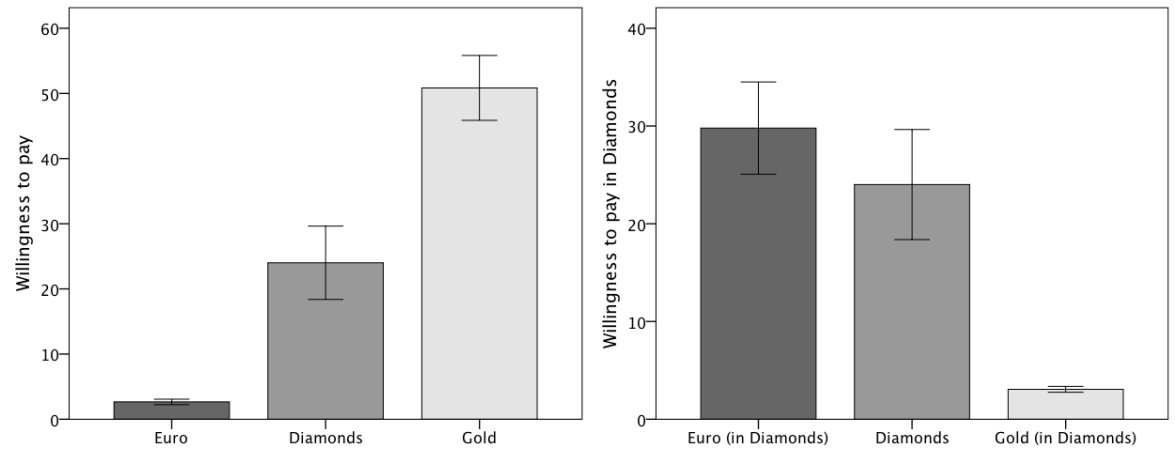

Figure 1. Left panel: willingness to pay in different currencies. Right panel: willingness to pay in different currencies with the Euro and Gold currencies converted to Diamonds. The error bars represent 95% confidence interval.

The participants were willing to pay most for the Unlock product when considering purchases in each of the currencies, in euros ($F(2, 352.59) = 13.46$; $p < .001$), in diamonds ($F(2, 714) = 6.49$; $p = .002$), and in gold ($F(2, 714) = 43.518$; $p < .001$; Fig. 2).

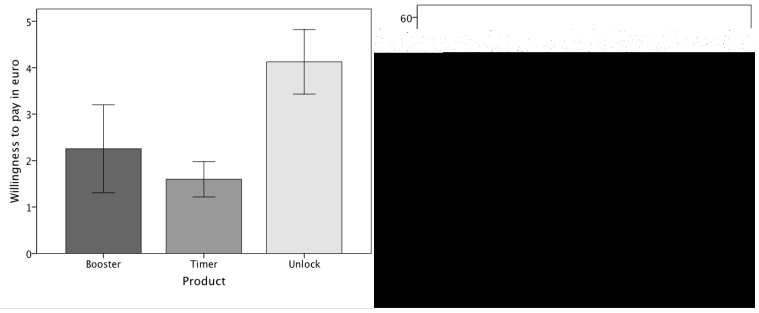

Figure 2. Willingness to pay in euro (left), diamonds (center), and gold (right) for different products. The error bars represent 95% confidence interval.

The participants were willing to pay most euros when the amount of resources (in virtual currencies) was moderate, compared to when there were scarce or plenty of resources ($F(2, 354.32) = 3.706$; $p = .026$; Fig. 3); although, the difference between Moderate and Plenty amount of Resources failed narrowly to reach statistical significance ($p = .074$), and needs to be verified when data from more participants is collected. On the other hand, the participants were willing to pay highest amount of gold when they had plenty of resources ($F(2, 714) = 57.32$; $p < .001$; Fig. 2).

participants possibly considered using real euros as peculiar and would have opted to use the abundant virtual currencies.

Regardless of the used currency, the players were willing to pay most for the Unlock product, which unlocks new game content. This is reasonable, after all, the Unlock opens actual new playing content and thus its value was probably considered as the highest. This finding is also in line with the previous findings of Hamari and colleagues (2017), who identified "Unlocking content" as one of the six motivations that explain in-game content purchases.

One of the limitations of the current study is the rather small sample size, which inhibits the generalizability of the findings. Thus, we plan to collect more data to reach 40 total participants. After the additional data has been collected we intend to analyze also the collected EEG (electroencephalography) data to study the neural mechanisms related to the economic decision-making processes. In addition, we will explore the possibility to convert this setting to a web experiment, which would enable the collection of a significantly larger sample. In future studies we intend to also gradually add and manipulate for example the visual-aesthetic features of the "game" and to study how these would affect the decision making.

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